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## PATENT ABSTRACTS OF JAPAN

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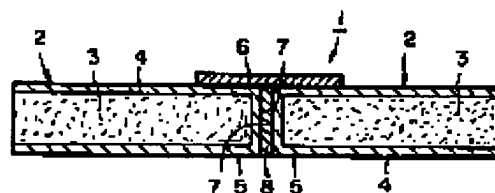
## (54) SANDWICH STRUCTURE AND ITS MANUFACTURE

## (57)Abstract:

PROBLEM TO BE SOLVED: To easily, inexpensively, integrally connect ends of a sandwich structure without using a clamping member or the like by providing an FRP coupling layer extended to overall surfaces of both the ends, and providing layers each containing a resin diffused medium between butted end faces.

SOLUTION: An FRP coupling layer 6 extended to overall surfaces of one end 5 to the other end 5 is provided on surfaces of both the butted ends 5 of adjacent sandwiched panels 2, and an FRP coupling layer 6 is integrally connected to FRP skin plates 4 of the panels 2. A layer 8 containing a resin diffused medium is provided between butted end faces 7 of the adjacent panels 2 to integrally connect the butted faces 7 with cast curd resin.

The medium contained in the layer 8 is constituted as the resin diffused medium made of a net-like material as the state before casting the resin.



## LEGAL STATUS

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CLAIMS

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[Claim(s)]

[Claim 1] The sandwich-structure object characterized by preparing the layer containing a resin diffusion medium between comparison end faces while preparing the FRP connection layer prolonged over the front face of both ends in the sandwich-structure object which has the FRP skin board arranged to core material and its both sides, compared edges, and was joined.

[Claim 2] The sandwich-structure object of a claim 1 with which a resin diffusion medium consists of a reticulum.

[Claim 3] The sandwich-structure object of a claim 1 with which a resin diffusion medium consists of the block object or board with which it has a resin inlet and resin passage was formed in the front face.

[Claim 4] The sandwich-structure object according to claim 1 to 3 with which the FRP layer is prepared in the circumference of a resin diffusion medium.

[Claim 5] The sandwich-structure object according to claim 1 to 4 with which the FRP connection layer is arranged in the crevice formed in the front face of the aforementioned both ends, and the front face of a sandwich-structure object and the front face of an FRP connection layer contiguous to this crevice are formed flat-tapped substantially.

[Claim 6] Roofing made from FRP characterized by preparing a fireproof layer at least in one side of a sandwich-structure object according to claim 1 to 5.

[Claim 7] While facing comparing the edges of the sandwich-structure object which has arranged the FRP skin board to both sides of core material, and joining and arranging a resin diffusion medium between comparison end faces Arrange reinforcement fiber over the front face of both ends, cover the arrangement section of a resin diffusion medium and reinforcement fiber by the bag base material, and the interior is made into a vacua. The manufacture method of the sandwich-structure object characterized by infiltrating reinforcement fiber while injecting a resin into a resin diffusion medium portion and making it spread to a reinforcement fiber portion, stiffening a resin, and joining edges to one.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention -- an FRP sandwich-structure object and its manufacture method -- being related -- especially -- the edges of a sandwich-structure object -- conclusion -- it is related with the sandwich-structure object it enabled it to join to one easily, and its manufacture method, without using a member etc.

[0002]

[Description of the Prior Art] Though it is lightweight, the FRP sandwich-structure object which has arranged the FRP skin board to both sides of the core material which consists of a foam, wood, etc. as the structure which has high intensity and high rigidity is known. Conventionally, the so-called lap joint method which arranges an FRP skin board, the board of a material of the same kind, or a metal plate to the vertical side of the compared sandwich-structure object, and binds tight and concludes it from the upper and lower sides using a penetration bolt is usually used for connection of such sandwich-structure objects.

[0003]

[Problem(s) to be Solved by the Invention] However, by the above lap joint methods, when it is necessary to make the edge of a sandwich-structure object penetrate a bolthole especially and comparatively big shearing stress acts by tension, in order to bear it, it is necessary to use the big bolt of a path, and a bolthole also becomes a major diameter. By punching of such a bolthole, there is a possibility that own intensity of a sandwich-structure object may fall. Moreover, although the method of thickening thickness of reinforcement of a joint portion, i.e., the FRP skin of this portion, is common in order to suppress an on-the-strength fall, it has the problem that a manufacturing cost becomes high by reinforcement.

[0004] Moreover, since the head of a bolt is exposed, although methods, such as forming covering further on it, may be taken from a viewpoint of a feeling of beauty, this also causes cost increase.

[0005] Furthermore, in a part for connection of sandwich-structure objects, or a joint, since a rigid abrupt change arises by the above-mentioned reinforcement etc. not to mention the above-mentioned bolthole, the stress concentration by the load happens and there is also a possibility that the portion may serve as an origin of destruction.

[0006] the trouble in the lap joint methods with the especially above technical problem of this invention -- paying one's attention -- the edges of a sandwich-structure object -- conclusion -- it can join to one easily and cheaply, without using a member etc., moreover intensity and rigidity high enough can be given to a joint, and it is in offering the sandwich-structure object excellent also in appearance, and its manufacture method

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, while preparing the FRP connection layer prolonged over the front face of both ends in the sandwich-structure object which the sandwich-structure object of this invention has the FRP skin board arranged to core

material and its both sides, compared edges, and was joined, it is characterized by preparing the layer containing a resin diffusion medium between comparison end faces.

[0008] It can also constitute from the block object and board with which it can also constitute from a reticulum, and has a resin inlet as the above-mentioned resin diffusion medium, for example, and resin passage was formed in the front face. Around this resin diffusion medium, it is desirable that the FRP layer is prepared further.

[0009] Although an FRP connection layer can be prepared in adjoining one side or adjoining both sides of both ends of a sandwich-structure object as it is and can also be used for junction, the FRP connection layer is arranged in the crevice formed in the front face of the aforementioned both ends, and the front face of a sandwich-structure object and the front face of an FRP connection layer contiguous to this crevice can also consider it as the composition currently formed flat-tapped substantially.

[0010] As for the sandwich-structure object concerning such this invention, it is desirable to be able to develop to roofing and to prepare a fireproof layer at least in one side of a sandwich-structure object in that case.

[0011] The manufacture method of the sandwich-structure object concerning this invention While facing comparing the edges of the sandwich-structure object which has arranged the FRP skin board to both sides of core material, and joining and arranging a resin diffusion medium between comparison end faces Arrange reinforcement fiber over the front face of both ends, cover the arrangement section of a resin diffusion medium and reinforcement fiber by the bag base material, and the interior is made into a vacua. While injecting a resin into a resin diffusion medium portion and making it spread to a reinforcement fiber portion, reinforcement fiber is infiltrated, and it consists of a method characterized by stiffening a resin and joining edges to one.

[0012] The edges of an adjoining sandwich-structure object are joined in the sandwich-structure object concerning the above this inventions by the FRP connection layer prolonged so that between one side of both ends or both sides may be crossed, and the layer containing the resin diffusion medium formed between comparison end faces. Like [ in the case of the conventional lap joint method ], since it is not necessary to prepare a bolthole, the intensity of a sandwich-structure object main part and a rigid fall are not. Moreover, since it is fundamentally joined using a material of the same kind in addition to there being no bolthole, there is also no rigid abrupt change and stress concentration is avoided. Furthermore, since reinforcement is unnecessary to an FRP skin board etc., a manufacturing cost is also cheap.

[0013] Moreover, since the head of a bolt is not exposed, appearance is also good, additional members, such as covering, are also unnecessary, and it is manufactured cheaply also from this field.

[0014] furthermore -- since a resin spreads round a quick and efficient required part through a resin diffusion medium, it sinks into reinforcement fiber in the manufacture method of the sandwich-structure object concerning this invention and a predetermined joint can be fabricated -- the edges of a sandwich-structure object -- one -- and it is joined firmly Moreover, since what is necessary is to apply only to a joint locally, this junction method can be constructed sufficiently easily also on the spot.

[0015]

[Embodiments of the Invention] Below, the gestalt of desirable operation of this invention is explained, referring to a drawing. Drawing 1 shows the cross section of the joint of the sandwich-structure object which takes like 1 operative condition as for this invention. In drawing, 1 shows the whole sandwich-structure object and 2 shows each sandwich-structure object (henceforth a sandwich panel) each other joined. Each sandwich panel 2 arranges the FRP skin board 4 (FRP skin) to both sides of the core material 3 which consists of a foam, wood or a honeycomb object, etc., and becomes them from what fabricated these in one. In this embodiment, the FRP skin board 4 is continuously connected so that it may turn from one front-face side to the front-face side of another side in an edge.

[0016] The FRP connection layer 6 prolonged so that it may migrate to the front face of the other-end section 5 from the front face of one edge 5 is formed in the front face of the both ends 5 of the sandwich panel 2 which is compared and adjoins, and it is joined in [ the FRP connection layer 6 and the FRP skin board 4 of each sandwich panel 2 ] one. In this embodiment, although the FRP connection layer 6 is formed only in the one side side, if shown in the example of below-mentioned drawing 6 , it may be

similarly prepared in both sides.

[0017] Between the comparison end faces 7 of the adjoining sandwich panel 2, the layer 8 containing a resin diffusion medium is formed, and this layer 8 has joined both comparison end-face 7 comrades in one with the resin poured in and hardened.

[0018] As a gestalt before resin pouring, the resin diffusion medium contained in the above-mentioned layer 8 is constituted, as shown in drawing 2 or drawing 3. Modes shown in drawing 2 can be consisted of by the resin diffusion medium 9 which consists of a reticulum, and a pouring resin can be diffused now through this resin diffusion medium 9 between both the comparison end faces 7 and in the direction of the aforementioned FRP connection layer 6. At the time of fabrication, the layer which consists of reinforcement fiber previously is arranged, it sinks in, the resin diffused through the resin diffusion medium 9 is hardened, and the FRP connection layer 6 turns into the FRP connection layer 6.

[0019] Modes shown in drawing 3 are consisted of by the resin diffusion medium 10 which consists of a block object, and this resin diffusion medium 10 has the resin passage 12 which consists of a slot prolonged on a front face at every direction or/, and a hoop direction while having the resin inlet 11. The resin poured in from the resin inlet 11 is diffused to a predetermined part through the resin passage 12. Although this resin diffusion medium has illustrated the example of a block object in drawing 3, it may be a board.

[0020] Moreover, as shown in drawing 4, the FRP layer 13 may be formed in the circumference of the layer containing the above-mentioned resin diffusion medium or a resin diffusion medium. This FRP layer 13 is arranging the reinforcement fiber layer which constitutes the FRP layer 13 around a resin diffusion medium before resin pouring to the above-mentioned resin diffusion medium, and can be constituted automatically at the time of resin pouring and junction.

[0021] Moreover, as shown in drawing 5, the crevice 14 is formed in the front face of the both ends 5 of the adjoining sandwich panel 2, respectively, and the FRP connection layer 6 can also be arranged in a crevice 14 so that it may migrate to both the crevices 14. If it does in this way, it will become possible like illustration to make flat-tapped substantially front faces other than crevice 14 of a sandwich panel 2, and the front face of the FRP connection layer 6.

[0022] If the structure which arranges the FRP connection layer 6 in the crevice 14 shown in drawing 5, the structure using the resin diffusion medium 10 shown in drawing 3, and the structure which arranges the FRP connection layer 6 to both sides are adopted, it comes to be shown, for example in drawing 6.

[0023] Moreover, the sandwich-structure object of this invention which has such structure can be used suitable for roofing etc. As it is shown in drawing 7 in using for roofing etc. in order to raise refractoriness for example, it is desirable to form the fireproof layer 15 at least in one side of a sandwich-structure object. As a refractory material which constitutes the fireproof layer 15, the fireproof plastics material of a refractory paint or foaming nature can be used. If foaming nature refractoriness plastics material is heated by predetermined temperature, it will foam to it, and it demonstrates adiathermancy ability.

[0024] Sandwiches style <TXF FR=0001 HE=250 WI=080 LX=0200 LY=0300> \*\*\*\* 1 concerning the above this inventions can be manufactured as follows, for example. It faces comparing edge 5 comrades of a sandwich panel 2, and joining, and between the comparison end faces 7, the resin diffusion medium 9 (or 10) is arranged, and reinforcement fiber is twisted around the circumference of the resin diffusion medium 9 depending on the case. Moreover, cotton is carried out among both the crevices 14 that carry out cotton between the front faces of the both ends 5 of a sandwich panel 2, or are formed there, and a reinforcement fiber layer is arranged to one side or both sides. This whole joint part is covered by the bag base material (for example, film-like covering material) in which a seal is possible, and the interior is attracted with a vacuum pump etc., it is made a vacua, and a resin is injected into resin diffusion medium 9 portion. Since it considers as the vacua, while diffusing a pouring resin quickly and spreading between the comparison end faces 7, when reinforcement fiber is twisted around the circumference of the resin diffusion medium 9 by which it is spread also in the above-mentioned reinforcement fiber layer arranged on the front face, and sinks into the reinforcement fiber layer simultaneously, it spreads and sinks also into this reinforcement fiber layer. By stiffening the poured-in resin, both the sandwich panels

2 are joined in one with the resin which the FRP connection layer 6 consisted of the reinforcement fiber layers and impregnating resins which have been arranged on the front face, and was hardened between the comparison end faces 7. When reinforcement fiber is twisted around the circumference of the resin diffusion medium 9, while the FRP layer 13 also consists of this portion and joining both the sandwich panels 2 in one, the function of a reinforcing rib is also achieved.

[0025] Thus, above-mentioned drawing 1 and the sandwich-structure object 1 as shown in 4, 5, and 6 are manufactured, and roofing made from FRP as shown in drawing 7 is manufactured by forming the fireproof layer 15 further.

[0026] In the sandwich-structure object 1 concerning this invention manufactured as mentioned above, since a bolthole becomes unnecessary to a joint fundamentally, neither the intensity of sandwich-panel 2 main part nor rigidity falls. Moreover, in the surface portion of a sandwich panel 2, and the portion between the comparison end faces 7, since it is substantially joinable using FRP material of the same kind and a resin of the same kind, junction nature is very good, does not have a rigid abrupt change, either, and can also avoid stress concentration.

[0027] Moreover, since sufficient intensity and rigidity are securable, need to add reinforcement fiber etc., it is not necessary to reinforce it further, and a manufacturing cost is also cheap like [ in the case of the conventional lap joint method ]. Moreover, since there is also no problem which the bolt-head section exposes, appearance is good and additional members, such as covering material, also have it. [ unnecessary ]

[0028] Furthermore, if reinforcement fiber is arranged to the circumference of a resin diffusion medium and the FRP layer 13 is constituted as shown in drawing 4 , the firm rib structure can be constituted in a part for this joint, and intensity and rigidity can be improved further. Moreover, if the fireproof layer 15 is formed as shown in drawing 7 , reliable roofing will be realized to a fire etc.

[0029] Moreover, if the sandwich-structure object 1 applied to this invention by the above manufacture methods is manufactured, junction work can be done easily and cheaply and construction will become possible also on the spot.

[0030] In addition, especially strengthening fiber or the matrix resin of FRP in the sandwich panel itself, an FRP connection layer, etc. of a sandwich-structure object concerning this invention are not limited, but can adopt any well-known things. For example, as strengthening fiber, a carbon fiber, a glass fiber, an aramid fiber, etc. can be used, and various thermoplastics besides thermosetting resin, such as an epoxy resin, phenol resin, an unsaturated polyester resin, and vinyl ester resin, can also be used as a matrix resin.

[0031]

[Effect of the Invention] It can form in the appearance which was excellent while according to the sandwich-structure object of this invention being able to solve the trouble in the conventional lap joint method at once, being able to join the edges of a sandwich-structure object firmly and cheaply easily and being able to secure the high intensity of a joint, and rigidity, as explained above.

[0032] Moreover, according to the manufacture method of the sandwich-structure object concerning this invention, it can construct easily and cheaply and junction work [ in a site ] is also attained.

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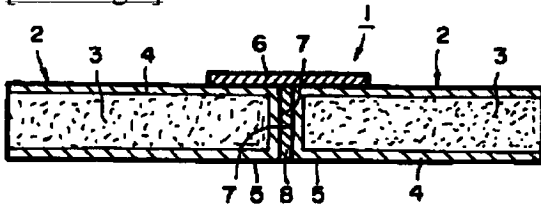
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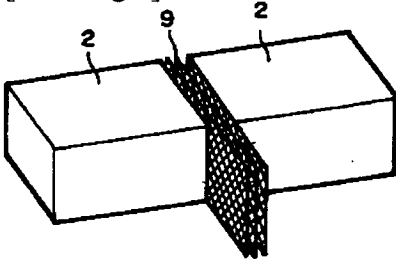
DRAWINGS

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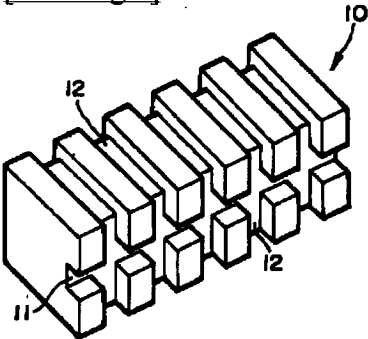
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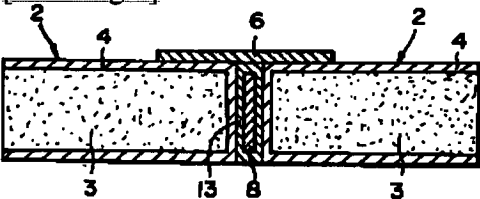
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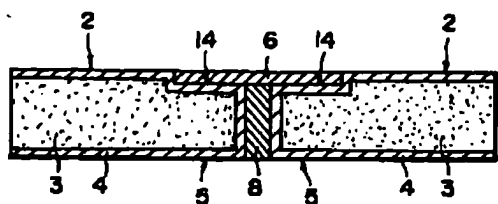
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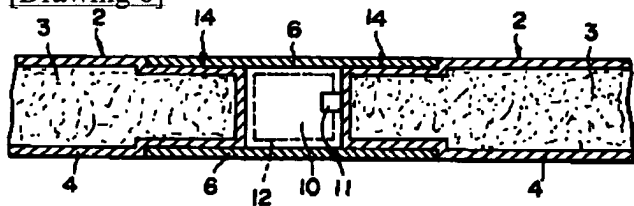
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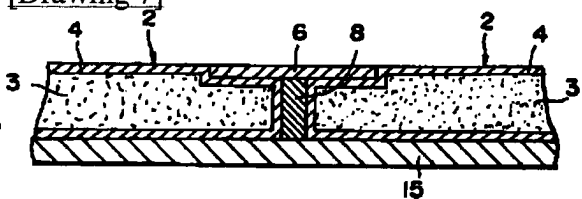
[Drawing 5]



[Drawing 6]



[Drawing 7]



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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the cross section of the sandwich-structure object which takes like 1 operative condition as for this invention.

[Drawing 2] It is a perspective diagram before the junction which shows an example of the resin diffusion medium in the sandwich-structure object of drawing 1 .

[Drawing 3] It is the perspective diagram showing another example of a resin diffusion medium.

[Drawing 4] It is the cross section of the sandwich-structure object concerning another embodiment of this invention.

[Drawing 5] still more nearly another operative condition of this invention -- it is the cross section of the sandwich-structure object applied like

[Drawing 6] still more nearly another operative condition of this invention -- it is the cross section of the sandwich-structure object applied like

[Drawing 7] It is the cross section of roofing made from FRP which takes like 1 operative condition as for this invention.

[Description of Notations]

- 1 Sandwich-Structure Object
- 2 Each Sandwich-Structure Object (Sandwich Panel)
- 3 Core Material
- 4 FRP Skin Board
- 5 Edge
- 6 FRP Connection Layer
- 7 Comparison End Face
- 8 Layer Containing Resin Diffusion Medium
- 9 Resin Diffusion Medium Which Consists of a Reticulum
- 10 Resin Diffusion Medium Which Consists of a Block Object
- 11 Resin Inlet
- 12 Resin Passage
- 13 FRP Layer
- 14 Crevice
- 15 Fireproof Layer

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